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Relation between government expenditure and economic growth

Bibhu Prasad Aryal
Eastern Illinois University

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Relation Between Government Expenditure and Economic Growth

(TITLE)

BY

Bibhu Prasad Aryal

THESIS

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Minh Q. Dao
THESIS DIRECTOR

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Charles Garbanzo
DEPARTMENT/SCHOOL HEAD

Abstract

Government expenditure depends upon the available resources and the scope of saving potential of the country. But the same requires a proper expenditure policy, so that the desired objectives of planned economic development could be achieved within a short span of time. In order to formulate the proper economic policy it is very necessary to know the importance of the causal relation of the expenditure and economic variables.

This paper investigates the causal relation between government expenditure and GDP growth. To find out the relationship between the two variables, a sample of eight developing countries from Asia and Africa is selected and annual time series data from 1972 to 2003 has been used. Three separate models to test for Wagner's law, Keynesian hypothesis and Granger causality have been developed in this paper.

First chapter of the paper deals the introduction including statement of problem and some historical facts. Second chapter describes the review of literature and hypothesis.

Third chapter of the paper deals about the model of the thesis. Fourth chapter is the empirical result part of the paper. The chapter begins with the procedure of checking the order of integration on data, establishing a long-run relationship between the two series and conducting error correction mechanism to control the short term disturbances. Finally, the empirical results of Granger causality tests are included in this chapter.

Fifth chapter is the last part of this paper which includes conclusion and suggestions for future research.

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Relation between Government Expenditure and Economic Growth: An Econometric Evidence

Chapter – 1

1.1 Introduction:

The ultimate goal of any government is to make its own country economically sound. To achieve this goal the government has to implement a good economic policy. Economic growth could be used as a synonym to development, which can be defined as the increase in real GDP Per capita which occurs over a period of time.

Growth can, also, be defined in such a way that the increase of total output relative to population means a higher standard of living. So, by definition a growing economy enjoys an increment in its annual real output to satisfy existing needs more effectively. Government's proper fiscal policy will help the country to achieve the central economic objective of higher and stable level of growth.

Government expenditure is just like a barometer which measures the course of economic development as well as the administrative skill of the government in a country. The relationship between economic growth and the magnitude of government expenditure has been a lively controversy among the countries in the world.

The main objective of this paper is to examine the causal relationship between growth of the nation and that of government expenditure of 8 developing countries of Asia and Africa. Three countries are chosen from Asia, namely Indonesia, Myanmar, and Turkey. Similarly, the remaining five countries are chosen from Africa namely,

Burkina Faso, Kenya, Nigeria, Senegal, and Swaziland. Government undertakes expenditures to pursue a variety of goals, only one of them is an increase in GDP. I want to focus on GDP growth because GDP growth is the major objective of any developing country's government.

Government expenditure is one major process by which the welfare of the people is examined and it is a vital aspect of a government's budget. It is an important instrument in the hands of the government that can be utilized for the maximization of public satisfaction.

The classical approach to the subject of public expenditure was based on the assumption that government is merely an agent for the people and has to spend people's money discreetly and sparingly. In other words classical economists were the supporters of Laissez-faire policy. They also favored the principle of a balance budget. I, therefore, think that the classical ideas of minimum public expenditure and balanced budget have got no application in the context of a developing country where the public sector has to play a key role in promoting the growth of the economy.

Among the neoclassical economists, Professor Pigou discussed the principle of public expenditure. He was mainly concerned with the problem of maximizing the social benefit. According to him if resources are so distributed among different uses that the marginal returns of satisfaction are the same for all of them[1].

According to Singh (1983), Lord Keynes, who propounded the theory of public expenditure, argued that public expenditure can be used as a balancing factor

[1] Pigou, A.C., A Study of Public Finance, Macmillan Co., London, 1956, p.31

in the economy. He argued that if there is imbalance between investment and saving thereby causing a recession or a depression in a country, the government could control such a situation by increasing expenditure on public works. According to Keynes public expenditure plays a role to increase aggregate demand and creates more employment. This new expenditure will set out a chain of expenditures on the part of successive income recipients and increase national income to a multiple.

Developing countries government always lack resources to investment in development sectors like road maintenance, bridge construction, water plant, electricity supply etc. That's why most of developing countries implement deficit spending in order to conduct development activities throughout the nation. In developing countries government can not invest its total spending in developing activities because a big portion of the budget goes to consumption. Government in developing countries spend an average 26 percent of GDP on goods and services, a figure which has risen by 8 percentage points over the last fifteen years (Devarajan et al, 1996). Besides, the portion of saving in the government budget is always lower in such countries which forces government to borrow money to invest in national building activities.

Various observations distinguish between 'productive' and 'unproductive' public expenditures, and show how a country can improve its economic performance by changing the mix between the two. Some countries cut their spending in one sector such as road maintenance and increase spending to another sector such as water supply in order to manage the fiscal policy. But I think it is not a good idea to

cut spending of any sector without knowing the contribution of that sector to the economy.

Government spends its money mainly in the education, defense, health, infrastructure and other economic and social sectors. That's why government needs to do an empirical test to find out whether these sectors have maintained a positive relation or a negative relation with growth before making any changes. That's why data should be analyzed before making changes in any components of government expenditure.

Various studies have been done to find out the relation of public expenditure and growth. In this paper, I will shed light on the relationship between government expenditure and economic growth by employing Granger causality test.

The main reason for the selection of this topic is to study the benefits received by the people out of huge amount of public expenditure incurred by the government of selected developing countries. In other words, this study establishes a statistical synthesis between behaviors of government expenditure and economic development and leads to some definite and concrete conclusions regarding the framework of fiscal policy in those countries.

Wagner (1883), writing more than one hundred years ago, offered a model of the determination of public expenditure in which public expenditure growth was a natural consequence of economic growth; later, his views were formulated as a law and were often referred to as 'Wagner's Law'. This law states that public expenditure increases at a faster rate than that of national output. In other words, as per capita

income rises in industrializing nations, their public sector will grow in relative importance.

Granger causality is a technique for a determining whether one time series is useful in forecasting another. Clive Granger, who won Nobel Prize in economics, argued that there is an interpretation of a set of tests as revealing something about causality. Granger definition of causality is defined as follows: "x is a Granger cause of y (denoted as x $\rightarrow$ y), if present y can be predicted with better accuracy by using past values of x rather than by not doing so, other information being identical" (Demirbas, 1999).

As mentioned earlier, three separate models to test for Wagner's law, Keynesian hypothesis and Granger causality have been developed in this paper.

First chapter of the paper deals the introduction including statement of problem and some historical facts. Second chapter describes the review of literature and hypothesis of the thesis.

Third chapter of the paper deals about the model of the thesis. Fourth chapter is the empirical result part of the paper. The chapter begins with the procedure of checking the order of integration on data, establishing a long-run relationship between the two series and conducting error correction mechanism to control the short term disturbances. Finally, the empirical results of Granger causality test are included in this chapter.

Fifth chapter is the last part of this paper which includes conclusion and suggestions for future research.

Chapter – 2

2.1 Review of Literature

Landau (1983) studied 104 countries on a cross sectional basis, using an earlier form of the Summers-Heston data. The growth rates examined were for the period 1961 – 70, 1961 – 72, 1961 – 74, and 1961 – 76; and the shorter periods 1961 – 68, and 1970 – 76 were also tested. He found a significantly negative relation between the growth rate of real GDP per capita and the level of government consumption expenditures for all four longer periods. The coefficient is significant at the 5 % level for 1961 – 70 and 1961 – 72; and at the 1% level for 1961 – 74 and 1961 – 76 periods. The coefficient estimates the shorter time period of 1961 – 68 and 1970 – 76 was also had a negative sign. Moreover, he argued that low per capita income countries have in fact grown slowly than the middle or high income countries. Since the coefficient for per capita income in the regressions is negative, the writer concludes that the two variables (a) the share of government expenditure in GDP and (b) investment in education are responsible for the slow growth of lower income countries.

Barro (1989) studied 98 countries in the post World War II period, 1960 – 1985. He found the growth rate of real per capita GDP is positively related to the initial human capital and negatively related to the initial (1960) level of real per capita GDP. According to his study, growth is inversely related to the share of government consumption in GDP, but insignificantly related to the share of public

investment. However, growth rates are positively related to measures of political stability and inversely related to a proxy for market distortions. The author has modified the existing data, prepared by Summers-Heston, of government consumption. He measured the ratio of real public gross investment to real GDP, denoted by g^c/y and found a significantly negative association between g^c/y and growth.

Devarajan et al (1996) studied 43 developing countries over 20 years, 1970 through 1990. Their empirical analysis has focused on the link between various components of government expenditure and economic growth. The authors assume that the aggregate production function has three arguments: (i) Private capital stock, k, and two types of government spending, g_1 (productive) and g_2 (unproductive). A Constant Elasticity of Substitution (CES) function is used to show the relation among k, $g_1$and g_2. That is:

$$Y = f(k, g_1, g_2) = [\alpha k^{-\zeta} + \beta g_1^{-\zeta} + \gamma g_2^{-\zeta}]^{-1/\zeta}$$

Where $\alpha > 0, \beta \geq 0, \gamma \geq 0, \quad \alpha + \beta + \gamma = 1, \quad \zeta \geq -1.$

In the empirical analysis the authors have tested whether the share allocated to different components of government expenditure is associated with higher growth. Using Ordinary Least Square (OLS) method they have run a regression and found a positive and statistically significant relationship between consumption expenditure and GDP growth.

By contrast, the empirical result has shown a negative and statistically significant relationship between the capital component of public expenditure and per capita growth.

Given the surprising nature of such results, the writers ran another regression with a sample of 21 developed countries and found the reverse conclusion. That is the coefficient for capital expenditure is positive and statistically significant and the coefficient for current expenditure is negative and statistically significant.

The authors have mentioned that productive expenditures could become unproductive if used in excess. They have concluded their article with the findings that developing country governments have been misallocating public expenditures in favor of capital expenditures at the expense of current expenditure.

Al-Faris (2002) studied the relation between public expenditure and economic growth in the Gulf Cooperation Council (GCC) countries namely Saudi Arabia, the United Arab Emirates, Kuwait, Oman, Bahrain, and Qatar using annual data for the period 1970 – 1997. The primary aim of the article was to investigate empirically public expenditure and economic growth relationship within the framework of Wagner's Law and Keynesian hypothesis. According to the writer Wagner's law suggests the existence of a causal relationship between national income and public expenditure. Similarly the writer has mentioned that within the Keynesian macroeconomic framework, the relationship between economic growth and public expenditure is perceived to be inverse. Based on the multivariate co-integration methodology the following result was found. For all cases there is a unidirectional

causality from GDP to public expenditure, which supports Wagner's law. However, the writer has found the refutation of Keynes's postulation in the result.

Gomanee et al.(2005) studied the relation between aid, government expenditure and aggregate welfare. The study was based on data for 104 low-income and middle-income countries over the period of 1980 to 2000. The estimation is done using the following equation:

$$W_{it} = \delta_0 + \delta_1 GDP0 + \delta_2 PPE_{it} + \delta_3 Gm_{it} + \delta_4 A_{it-1} + \varepsilon_{it}$$

Where,

W	=	Welfare
GDP0	=	Real GDP per capita in the year preceding the period
PPE	=	Pro-public expenditure which includes government expenditures on sanitation, health services and education
Gm	=	government spending on military expenditure
A	=	measure of aid

The authors have found little evidence that aid imports welfare via pro-public expenditures (PPE) that aid also tends to increase PPE for low-income countries, and that the various measures of PPE have no significant effect on aggregate welfare for such countries. Only for middle income countries, PPE is associated with increased welfare.

Le et al. (2005) studied the relation of foreign direct investment and public expenditure with growth for the period of 1970 -2001, using a sample of 105 developing and developed countries. In this study the econometric model used is

based on the studies of Barro (1991), Devarajan et al.(1996) and Borensztein et al.(1998), in which the production function depends on the FDI, public capital expenditure, public non-capital expenditures, and domestic investment. Using OLS method, the following equation is used for the estimation:

$$Growth_{i(t+1,t+5)} = a + b_1 Pubcap_{it} + b_2 Pubcur_{it} + b_3 Pricap_{it} + b_4 FDI_{it}$$

$$+ \sum_{J=1}^{4} b_j Dm_j + C_1 oda + d_1 edu + \varepsilon_{it}$$

Where,

$Growth_{i(t+1,t+5)}$	=	Five forward moving average of per capita GDP growth
Pubcap	=	ratio to GDP of annual public capital expenditure
Pubcur	=	ratio to GDP of annual public current expenditure
Pricap	=	ratio to GDP of annual private capital flow
FDI	=	foreign direct investment
Dm	=	income level dummy variable
oda	=	ratio of official development assistant to GDP
edu	=	secondary school enrolment ratio and
ε_{it}	=	error term

The authors have found that both public capital and public non-capital expenditures have significant impacts on per capita GDP growth rate. An increase in public capital expenditure leads to an increase in economic growth rate while the

effect caused by a high public non-capital expenditure is opposite. At this point the authors have included Barro's argument (1990) that public capital plays an important role in enhancing the productivity of private capital; where as an increase in public non-capital would create only a negative effect, as more tax is needed to finance this increase.

Musila et al (2004) did an empirical study, using time series data over the period 1965 to 1999 in Uganda to find out the relation between government education expenditure per worker and economic growth. Using the following production function model, the writer has hypothesized that increasing government education expenditure will accelerate economic growth.

$Yt = AK^{\alpha}_{t} L^{\beta}_{t} H^{\gamma}_{t}$

Where

Y = real income

A = technology parameter

K = physical capital

L = number of workers

H = total amount of human capital

Defining Ht = Et Lt, where Et = average level of education per worker, the model is rewritten as;

$Yt = AK^{\alpha}_{t} L^{\delta}_{t} E^{\gamma}_{t}$

Where, $\delta = \beta + \gamma$.

Using logarithmic transformation, the econometric model used in the empirical analysis in linear form is as follows:

$$LOGRGDP_t = a + \alpha LOGK_t + \delta LOGL_t + \gamma LOGE_t + \varepsilon_t$$

Where RDGP, K, L and E stand for real GDP, capital formation, employment and government education expenditure per worker respectively.

Given the historical data, the author has tested for integration and co-integration of the variables in the model in order to determine the appropriate estimation approach. The estimated long-run equilibrium (co-integrated) analysis showed that increase in average education expenditure per worker leads to higher output. In other words a 1% increase in average education expenditure per worker raises output by about 0.6%. Similarly, the estimates from the error correlation model (short run) show that a 1% increase in average education expenditure per worker leads to a 0.036% increase in output. In short the results indicate that average education expenditure per worker is positively correlated with economic growth.

Dritsakis et al. (2004), in their paper "A causal relationship between government spending and economic development: an empirical examination of Greek economy", studied the tendency of the increment of government spending as well as the relationship between government spending and economic growth. Using the data for 1960 to 2001 for Greece, the writers have made an effort to determine causal relationships between government spending and economic development through the use of Wagner theory. In order to avoid the spurious regression problem, the authors have tested the stationarity of all time series. Moreover the Dickey-Fuller (DF) as

well as the Adjusted Dickey-Fuller (ADF) test is also done to examine the unit root (stationary) in estimated equilibrium error. However the DF/ADF functions do not include a stationary term due to the formation of residuals according to the OLS method.

From the causality test it is noticed that in most cases the causality in both directions meaning that public spending increases economic development and that in the same period economic development has a positive effect on rising public spending. In other cases, like with general government spending, the causality model follows the simple Keynesian theory, while in total spending and in social welfare spending, this model follows Wagner's theory.

Wahab (2004) studied the relationship between economic growth and government expenditure of 25 OECD countries for the period between 1950 – 2000. Using Summer and Heston (2002) data, the writer has examined the two alternative states of the economy. The first is when the economy is growing at or above its 'normal' (trend) growth rate, and the second is when the economy's growth rate is below trend growth. In both instances, the bivariate relationship between government expenditure and economic growth is tested. This paper is concerned with the approach which suggests that government expenditure responds positively to changes in growth so that as a country's income rises so does the size of the country's public sector. Hence, government expenditure is income-elastic.

To capture total government expenditure in the model some important measures are used, for example expenditure on goods and services, interest payment,

subsidies, transfers and capital expenditure. For economic growth, real per capita GDP is used. The economy grows at or above trend-growth; government expenditure tends to increase inelastically. However, when economic growth slows to below trend-growth, in this situation, growth in government expenditure declines more than proportionately.

Mello (2002) did a case study of 26 local governments in Brazil using panel data of Brazilian municipalities during 1985 - 1994. In the article the main attention is focused on three expenditure categories; they are housing/urbanization, health/sanitation, and transport vehicles which are expected to be growth-enhancing. A hypothesis put forward in his paper is that the local government spending is affected by the size of the local jurisdiction (municipality), measured by the resident population.

Three different models were formulated to estimate the impact of local government spending on growth. Model 1 is a base line model in which the resident population and government spending are treated as exogenous, model 2 treats government spending as endogenous and finally model 3 treats resident population as endogenous. The focus is on the estimation of government spending on housing/urbanization, health/sanitation, and transport services. The OLS estimator with and without group dummies, and GLS estimates were used to find the empirical result. The finding has shown that spending on health/sanitation seems to have the strongest impact on economic growth at the local level. A nonlinear relationship

between population size and government spending is found in the case of housing/urbanization and health/sanitation.

Fan et al. (2000) studied the relationship among government spending, growth and poverty in rural India. In order to estimate the direct and indirect effects of different types of government expenditure on rural poverty and productivity growth the authors used state-level data for 1970 – 1993. They developed a simultaneous equations (19 equations) model to estimate the various direct and indirect effects of government expenditures on productivity and poverty. They used the Full Information Maximum Likelihood (FIML) technique to estimate the equation system. Results show that government expenditures on roads and Research & Development (R&D) have by far the largest impacts on poverty reduction and growth in agricultural productivity. Spending on productivity enhancing investment such as agricultural R&D and irrigation, rural infrastructure, and rural development targeted directly to the rural poor, have all contributed to growth in agricultural productivity. Government spending on education has the third largest impact on rural poverty and productivity growth.

Kolluri et al. (2000) studied the relationship between government expenditure and economic growth for G7 countries. The authors have examined Wagner's law of public expenditure using time series data over the sample period 1960 – 1993. Their objective is to determine if there exists a significant positive long-run relationship between government expenditure and national income. The model applies cointegration analysis to the study of Wagner's law by examining the short run

adjustment process to deviations from the long-run equilibrium relationship between government spending and national income. Moreover, a dynamic model relating public expenditure to income called, an Error Correction Mechanism (ECM), is developed. The error correction regression is then used to estimate the long-run income elasticity to government expenditure and to determine the impact of steady state growth on the level of such expenditure. The dependent variables used in the model represent three varieties of government expenditure, namely: total government expenditure (GE); government consumption expenditure (GC); and government transfer expenditure (TE). Gross Domestic Product (GDP) is measured in millions of local currencies. The empirical result shows that the logarithmic values of the government expenditure and income variables are found to be stationary in their first differences and thus are integrated of order one. The test result indicates the existence of a significant long-run equilibrium relationship between government spending and growth supporting Wagner's law. Similarly, the estimates of long-run elasticities of government expenditure with respect to national income indicate that government spending is income elastic in the majority of G7 nations.

Ahsan et al. (1992) studied public expenditure and national income causality for six highly industrialized countries of G7 members over the sample period from the early 1950s to the mid 1980s. In order to examine the existence (or absence) of causal relationships, zero restriction is imposed on certain coefficients of the lag polynomials. A standard F-test is then used for checking the statistical significance of these restrictions. As for the variable examined, both public expenditure (X) and

national income (Y) are measured in real per capita terms (1980 prices). For a trivariate test of Granger causality, four potentially omitted variables, namely the annual M1 (Z1) and M2 (Z2) growth rates, the nominal budget deficit (Z3), and the interest rate (Z4) are adopted.

The result shows that there was no evidence for causality in three cases (Canada, Germany and the US) at the bivariate level. But in the trivariate context, the article shows that there exists much diversity in the observed causality pattern among countries, both in direction, in sign of the impact of one variable on another, and in the relevance of various omitted variables.

Loizides et al. (2005) studied the relation between government expenditure and economic growth for three European countries namely the United Kingdom, Ireland and Greece. The authors applied bivariate as well as trivariate causality tests using time series data over the period from early 1950s to mid 1990s. Since empirical work on this paper covers both developed and developing nations, so it is really an interesting matter for anybody who wants to know whether similar or different results hold between these two categories of countries. The authors have conducted three different specifications in their studies – (a) a test for a causal link between the size of the public sector, as measured by the ratio of government expenditure relative to GNP (Gt), and real per capita income (Yt) at the bivariate level, (b) they include Gt, Yt and unemployment rate; and (c) substitute the unemployment rates for inflation rates. The purpose of these last two specifications is to investigate whether, by switching to a trivariate system from the bivariate one, the causality results would have unchanged

the causal link between Gt and Yt in every case examined. To test the presence of a unit root for each variable in the model, Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests are conducted in the study. The regression form of the ADF equation is

$$\Delta Wt = a_0 + a_1 t + \rho w_{t-1} + + \sum_{i=1}^{K} \lambda_i \Delta w_{t-1} + u_t$$

Where, ΔW = first difference of series W, K = lag order, t = time

Similarly, PP tests involve computing the following OLS regression:

$$W_t = a0 + a_1 W_{t-1} + a_2(t-T/2) + u_t$$

Where a_0, a_1, a_2 are the conventional least –square regression coefficients.

The result shows that in all countries public expenditure Granger causes growth in national income, which is born out by the bivariate as well as the trivariate analysis. It is also found that the Greece case is supportive of the Wagner hypothesis that increased output causes growth in public expenditure.

Dunne et al. (1999) studied the relation between military spending and economic growth in South Africa over the period 1964 to 1996. In their paper, the authors have specifically examined Granger causality on the basis of the existence of a cointegration relationship between real output and share of military expenditure in GDP. To establish the order of integration of an observed time series the authors have employed the unit root tests developed by Dickey-Fuller (DF). They employed two

variants of the tests, one with an intercept and one with an intercept and liner trend. For a time series (x_t), the test is based on the auto regression:

$$\Delta x_t = \mu_0 + \gamma_0 x_{t-1} + \sum_{i=1}^{K} \nu_i \Delta x_{t-1} + \eta_t \text{ ---------- (A)}$$

The intercept trend is based on the following regression:

$$\Delta x_t = \mu_0 + \mu_1 t + \gamma_0 x_{t-1} + \sum_{i=1}^{K} \gamma_i \Delta x_{t-1} + \eta_t \text{ ---------- (B)}$$

According to the authors both an intercept and linear trend are added in the model and the unit root null remains same for the both i.e., H_0: $\gamma_0 = 0$, but the critical values are different. Results of the DF test using the logarithm of the real GDP (y_t) with an intercept suggest that y_t is nonintegrated, which implies the absence of a unit root. But on the other hand equation (B) indicates the presence of a unit root. Then the authors conducted a test for a unit root in the share of military expenditure in GDP and found no evidence against the presence of a unit root. The authors carry out Granger causality and cointegration test to find out the existence of causality in South African economy and found that there is no causality from military expenditure to growth at the10 % significance level but the test rejects the no-causality null hypothesis at the 5% significance level. Therefore overall summary can be written as there does seem to be some causality from changes in military expenditure share to

output growths in South Africa. Regarding the relation between military expenditure and growth, the authors have found that there exists a significant negative impact of military burden on economic growth.

2.2 Hypothesis

Unless the governments in developing countries increase their expenditure in development activities, a higher GDP growth rate can not be achieved. Therefore they need to invest a big portion of their spending in such activities. I, therefore, hypothesize that in all selected developing countries, the Keynesian hypothesis applies.

Chapter – 3

3.1 Model:

As mentioned earlier, the focus of this paper is to evaluate empirically the causal link between government expenditure and GDP growth within a bivariate framework, by resorting to the technique of the cointegrated process. In the model, I have used the method of Ordinary Least Square (OLS) to estimate the causality effects between the two variables.

Regression models involving time series data sometimes give results that are spurious, or of dubious value, in the sense that superficially the results look good but on further investigation they look suspect (Enders, 1995). Broadly speaking, a stochastic process is said to be stationary if its mean and variance are constant over time i.e. the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed.

If the characteristics of the stochastic process change over time, i.e., if the process is non stationary, it will often be difficult to represent the time series over past and future intervals of time by a single algebraic model. On the other hand if the stochastic process is fixed in time, i.e., if it is stationary, then it is possible to model the process via an equation with fixed coefficients that can be estimated from past data. (Pindyck and Rubinfeld, 1981).

The investigation of stationarity (or non-stationarity) in a time series is closely related to the test of unit roots. Existence of unit roots in a series denotes non-

stationarity. A number of alternative tests are available for testing whether a series is stationary. In order to establish the order of integration in the data set, I employ the Augmented Dickey Fuller (ADF) test. The ADF test for unit roots indicate whether an individual series, say y_t, is stationary by running an OLS regression. The test is based on regression equation (1) given below.

The general form of ADF test can be written as follows:

$$\Delta Yt = a_0 + a_1 t + \rho Y_{t-1} + \sum_{i=1}^{m} \lambda_i \Delta Y_{t-1} + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, ΔY_t are the first differences of the series Y, m is the lag order and t stands for time.

3.2 The concept of co-integration:

Co-integration is the statistical implication of the existence of a long-run relationship between economic variables. In other words, from a statistical point of view, a long-term relationship means that the variables move together over time so that short-term disturbances from the long-run trend will be corrected (Demirbas 1999). The basic idea behind co-integration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary. A

lack of co-integration suggests that such variables have no long-run relationship: in principle they can wander arbitrarily far away from each other.

In a long-run period, a non-stationarity in the levels of variables could in principle cause a problem of spurious regressions and for that reason a co-integration test is necessary, in order to provide a long-term balance relationship between the examined variables (Dritaskis, 2004). A necessary and sufficient condition for co-integration is that the coherence between the two series is one at zero frequency (Engle and Granger, 1987).

Before testing for co-integration, that is, in order to establish the existence or otherwise of a long-run relationship between two economic time series, government expenditure and GDP growth, it is first necessary to test whether these variables are integrated to the same order.

The empirical analysis uses annual time series data of 8 developing countries (see appendix A for the data) from 1972 through 2003 to examine the causal relation between the government expenditure and economic growth within the bivariate frameworks. Some economists like Ahsan (1992), Demirbas (1999), Dristakis & Adamopoulos (2004) studied bivariate causality analysis between public expenditure and economic growth; conducted the Granger causality tests and found causality between the two variables. Therefore I believe the analysis of bivariate test offer a rich menu of possible causal pattern.

In the empirical analysis, I have conducted the following specification tests. That is (a) test for a causal link between government expenditure as a percent of GDP (now onward it is called EXP) and GDP growth (now onward it is called GDP).

3.3 Model to Test the Existence of Wagner's Law:

The Wagnerian approach can be defined as the growth in public expenditure is caused by growth in national income. To test the existence of Wagner's law using data from selected countries, this study will first establish the co-integration relation between government expenditure and GDP growth. The procedure used to establish the existence of a co-integrating relationship between the two series is as follows.

First, the long-run relationship is estimated by OLS, which is called the co-integrating regression. This expression can be given as:

$$\mathbf{EXPt = bGDPt + u_t} \ldots\ldots\ldots\ldots \mathbf{(2)}$$

Where EXP is government expenditure and GDP is GDP growth.

Second, the residuals from this regression are calculated and Engle & Granger tests are applied to the residuals, as follows:

$$\mathbf{u_t = \phi ut\text{-}1 + e_t} \ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(3)}$$

and test H_0: $\phi = 1$ is set against H_1: $\phi < 1$ using appropriate critical value.

If the variables EXPt and GDPt are considered as stochastic trends and if they follow a common long-run equilibrium relationship, then these variables should be

co-integrated. According to Engle and Granger (1987), co-integrated variables must have an ECM representation. The co-integration analysis provides a formal background for testing and estimating short-run and long-run relationships among economic variables. Furthermore, the ECM strategy provides an answer to the problem of spurious correlation (Loizides and Vamvoukas, 2004).

In order for two series to be co-integrated, two conditions must be met: (a) the two series must be integrated to the same order, and (b) a linear combination of the two series must exist which is integrated to a lower order than the individual series (Dao, 1994).

If two series EXP and GDP are co-integrated, then ECM will have the following form:

$$\Delta EXPt = \alpha \Delta GDPt + \lambda (EXP - bGDP)_{t-1} + v_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where, Δ indicates change in the series, and α and λ are parameters to be estimated.

3.4 Model to Test the Existence of Keynesian Hypothesis:

The Keynesian hypothesis suggested that GDP growth is caused by growth in public expenditure. To test the existence of this hypothesis using data from selected countries, this study will first establish the co-integration relation between government expenditure and GDP growth. The procedure used to establish the existence of a co-integrating relationship between the two series is as follows.

First, the long-run relationship is estimated by OLS, which is called the co-integrating regression. This expression can be given as:

$$\mathbf{GDPt = bEXPt + ut} \ldots\ldots\ldots\ldots \mathbf{(5)}$$

Where GDP is GDP growth and EXP is government expenditure.

Second, the residuals from this regression are calculated and Engle & Granger tests are applied to the residuals, as follows:

$$\mathbf{ut = \phi ut\text{-}1 + et} \ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(6)}$$

and test H_0: $\phi = 1$ against H_1: $\phi < 1$ using appropriate critical value.

If two series GDP and EXP are co-integrated, then ECM will have the following form:

$$\Delta GDPt = \alpha \Delta EXPt + \lambda (GDP - bEXP)_{t-1} + v_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where, Δ indicates change in the series, and α and λ are parameters to be estimated.

3.5 Granger Causality Test:

From the Granger causality analysis one can analyze in detail the causality relationship between the government expenditure and the economic growth. In econometrics the most widely used operational definition of causality is the Granger definition of causality. In order to examine Granger-causality the following equations are considered:

$$GDP_t = \sum_{i=1}^{n} \alpha_i EXP_{t-i} + \sum_{j=1}^{n} \beta_j GDP_{t-j} + u_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

$$EXP_t = \sum_{i=1}^{n} \lambda_i EXP_{t-i} + \sum_{j=1}^{n} \delta_j GDP_{t-j} + u_{2t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

Where, n is the number of lags and it is assumed that disturbances u_{1t} and u_{2t} are uncorrelated.

Stationary data will be applied to test the Granger causality. One can use standard F-tests in order to determine the causal relationship between the two variables. Interchanging the causal and the dependent variables in the regression equation allows a test for bi-directional causality.

Four findings are possible in a Granger causality test: (a) unidirectional causality from GDP to EXP meaning GDP causes EXP but not the other way round; (b) conversely, unidirectional causality from EXP to GDP, that is, EXP causes GDP but not vice versa; (c) GDP and EXP "Granger cause" each other, in this case there is a bidirectional causality between two variables; and (d) neither variable "Granger causes", in other words the sets of GDP and EXP coefficients are not statistically significant in both the regressions.

3.6 Data Collection:

Data is collected from International Financial Statistics of various years, World Development Indicator CD 2005, Human Development Reports published by UNDP for various years and some related web sites. In this study, I have collected GDP growth and government total expenditure (percent of GDP) annual time series data for eight developing countries from 1972 to 2003.

Chapter – 4

4.1 Empirical Results of Tests of Wagner's Law

In order to investigate stationarity in data, the ADF test for the unit root based on regression equation (1) is employed, which is presented in table 1.

Table 1, ADF test for unit root

Country	Variable	Critical value 5%	Calculated value	P value	m
Indonesia	GDP	-2.983	-3.738	0.0036	1
	EXP	-2.983	-3.144	0.0235	1
Myanmar	GDP	-2.986	-7.589	0.0000	2
	EXP	-2.986	-6.498	0.0000	2
Turkey	GDP	-2.983	-6.515	0.0000	1
	EXP	-2.983	-4.990	0.0000	1
Burkina Faso	GDP	-2.983	-7.976	0.0000	1
	EXP	-2.986	-7.227	0.0000	2
Kenya	GDP	-2.983	-5.289	0.0000	1
	EXP	-2.983	-3.491	0.0082	1
Nigeria	GDP	-2.983	-5.439	0.0000	1
	EXP	-2.983	-4.616	0.0001	1
Senegal	GDP	-2.983	-6.072	0.0000	1
	EXP	-2.986	-7.091	0.0000	2
Swaziland	GDP	-2.983	-4.253	0.0005	1
	EXP	-2.986	-3.830	0.0026	2

Applying the tests to first differences to determine the order of integration, the critical values are less (in absolute terms) than the calculated values of test statistics for Indonesia, Turkey, Kenya and Nigeria. Both the series of Myanmar are integrated of order two [I(2)], and become stationary after differentiating twice. But in the case of Burkina Faso, Senegal and Swaziland two series are not integrated of the same order. In all of these three countries EXP is integrated of order two [I(2)] but GDP is integrated of order one [I(1)].

Since all of the series are not integrated of the same order, the series may not be tested for the existence of a long-run relationship, i.e., a co-integration relationship. Therefore I decided to drop Burkina Faso, Senegal and Swaziland from the co-integration test. The series for the remaining five countries Indonesia, Myanmar, Turkey, Kenya and Nigeria will be tested for the existence of cointegration.

Using OLS method a regression is run (equation 2) to find out the co-integration relationship, which is given in table 2.

Table No.2, Co-integration test

Countries	Coefficient	Std. Error	t-value	P > | t |
Indonesia	0.28	0.15	1.82	0.078
Myanmar	-0.06	0.09	-0.64	0.525
Turkey	0.26	0.08	3.21	0.003
Kenya	-0.002	0.22	-0.01	0.994
Nigeria	-0.60	0.20	-3.0	0.005

Applying regression for the co-integration relationship between the two series, the above data show that Indonesia is significant at 10 percent; and Turkey and Nigeria are significant at 5 percent level exhibiting a long-run relation relationship between the two series in these countries.

To establish the existence of a co-integration relationship I only performed the step of the first process by running OLS. The second step to establish the cointegration relation between the two series is to test null hypothesis of non-cointegration of the residuals; therefore based on equation (3) I ran both DF test and ADF test of unit root. While doing the DF test, the OLS method is used to find out the value of ϕ. If $\phi = 1$, then e_t will be I(1) indicating non co-integration relation between the series. To establish the co-integration of the series null hypothesis has to be rejected.

Table 3, DF test for null hypothesis

Country	Critical value *	Calculated value	P > | t |
Indonesia	3.37	3.37	0.002
Myanmar	3.37	5.44	0.000
Turkey	3.37	2.03	0.052
Kenya	3.37	2.43	0.022
Nigeria	3.37	0.620	0.540

* Critical values for the t-statistics in this table are taken from the table 2, in Engle and Granger (1987).

Table no. 3 shows that there is a statistically significant long-run relationship between expenditure and GDP only in Myanmar. Now, to establish the long-run relation relationship between the two series using an ADF unit root test on the residuals; an OLS method is used. Table 4 presents the results of the ADF unit root test.

Table 4, ADF unit root test for residuals

Country	Critical Value 5%	Calculated Value	P-value
Indonesia	-2.983	-3.689	0.0043
Myanmar	-2.983	-2.142	0.2281
Turkey	-2.983	-3.815	0.0028
Kenya	-2.983	-3.490	0.0082
Nigeria	-2.983	-4.835	0.0000

Table no. 4 shows there exits a statistically significant long-run relationship between the two series for Indonesia, Turkey, Kenya and Nigeria. After doing the DF and the ADF tests of residual (table 3 and 4) I can conclude that the co-integration test of null hypothesis of non-cointegration for all the five countries namely Indonesia, Myanmar, Turkey, Kenya and Nigeria can be rejected. Therefore, a long-run co-integration relation has been established for all these five countries.

In the next step Error Correction Mechanism (ECM) is done using equation (4). All the five countries are included in the model. After running ECM for all five countries, the following results were obtained.

Table no.5, Error Correction Mechanism

Countries	ΔGDPt	t-value	$(EXP - bGDP)_{t-1}$	t-value	GDP_t **	t-value
Indonesia	0.359* (0.118)	3.04	0.435* (0.121)	3.59	0.28 (0.15)	1.82
Myanmar	0.030 (0.316)	0.46	0.316# (0.129)	2.45	-0.06 (0.09)	-0.64
Turkey	0.304* (0.051)	5.97	0.626* (0.178)	3.51	0.26* (0.08)	3.21
Kenya	0.124 (0.262)	0.47	0.615* (0.181)	3.40	-0.002 (0.22)	-0.01
Nigeria	-0.629* (0.147)	-4.27	0.890* (0.191)	4.65	-0.60* (0.20)	-3.0

* Significant at 1 percent level. # Significant at 5 percent level. ** Coefficients taken from equation no. (2). Standard errors are given in parentheses.

Table no. 5 shows that GDP growth is significant in three cases out of five. The error correction term λ is significant in all cases (Myanmar is significant at 5%) and its coefficient estimate has a positive sign in all cases which implies that the difference of the two series EXP and GDP scaled by the parameter b reaches stationarity. This process confirms that an equilibrium relationship between the two series will be attained in the long run.

To find out the existence of Wagner's law, table no 5 (sixth column) shows us that in Turkey as well as in Nigeria, in both cases, GDP growth is statistically significant. However the coefficient estimates for Turkey has a positive sign whereas the coefficient of Nigeria has a negative sign. That means Turkey data is supportive of the Wagner's law according to the ECM test.

4.2 Empirical Results of Tests of Keynesian Hypothesis

In order to investigate stationarity in data, the ADF test for the unit root based on regression equation (1) is employed and order of integration has already been established (table 1).

According to table 1, all the series are not integrated of the same order for three countries; therefore the series may not be tested for the existence of a long-run relationship for those countries. Only five countries Indonesia, Myanmar, Turkey, Kenya and Nigeria will be tested to find out the existence of co-integration.

Using OLS method a regression is run (equation 5) to find out the co-integration relationship, which is given in table 6.

Table No.6, Co-integration test

Countries	Coefficient	Std. Error	t-value	P > | t |
Indonesia	0.35	0.19	1.82	0.078
Myanmar	-0.24	0.38	-0.64	0.525
Turkey	0.98	0.31	3.21	0.003
Kenya	-0.001	0.15	-0.01	0.994
Nigeria	-0.38	0.13	-3.0	0.005

Applying regression for the co-integration relationship between the two series, the above data show that Indonesia is significant at 10 percent; and Turkey and Nigeria are significant at 5 percent level exhibiting a long-run relation relationship between the two series in these countries.

To establish the existence of a co-integration relationship I only performed the step of the first process by running OLS. The second step to establish the cointegration relation between the two series is to test null hypothesis of non-cointegration of the residuals; therefore based on equation (6) I ran both DF test and ADF tests of unit root. While doing the DF test, the OLS method is used to find out the value of ϕ. If $\phi = 1$, then e_t will be I(1) indicating non co-integration relation between the series. To establish the co-integration of the series null hypothesis has to be rejected.

Table 7, DF test for null hypothesis

Country	Critical value *	Calculated value	P > | t |
Indonesia	3.37	2.08	0.046
Myanmar	3.37	3.68	0.001
Turkey	3.37	0.47	0.639
Kenya	3.37	3.85	0.001
Nigeria	3.37	-0.38	0.705

* Critical values for the t-statistics in this table are taken from the table 2, in Engle and Granger (1987).

Table no. 7 shows that there is a statistically significant long-run relationship between expenditure and GDP only in Myanmar and in Kenya. Because calculated values for the both countries are greater than the critical value. Now, to establish the long-run relationship between the two series using an ADF unit root test on the

residuals; an OLS method is used. Table 8 presents the results of the ADF unit root test.

Table 8, ADF unit root test for residuals

Country	Critical Value 5%	Calculated Value	P-value
Indonesia	-2.983	-3.689	0.0043
Myanmar	-2.983	-2.846	0.0519
Turkey	-2.983	-5.032	0.0000
Kenya	-2.983	-5.287	0.0000
Nigeria	-2.983	-5.675	0.0000

Table no. 8 shows there exists a statistically significant long-run relationship between the two series for Indonesia, Turkey, Kenya and Nigeria. After doing Engle & Granger (DF and ADF) tests of residuals (table 7 and 8) I can conclude that the co-integration test of null hypothesis of non-cointegration for all the five countries namely Indonesia, Myanmar, Turkey, Kenya and Nigeria can be rejected. Therefore, a long-run co-integration relation has been established for all these five countries.

In the next step Error Correction Mechanism (ECM) is done using equation (7). All the five countries are included in the model. After running ECM for all five countries, the following results were obtained.

Table no.9, Error Correction Mechanism

Countries	ΔEXPt	t-value	$(GDP - bEXP)_{t-1}$	t-value	EXP_t **	t-value
Indonesia	0.331 (0.190)	1.74	0.643* (0.178)	3.61	0.35 (0.19)	1.82
Myanmar	-0.246 (0.452)	-0.54	0.436# (0.162)	2.69	-0.24 (0.38)	-0.64
Turkey	1.297* (0.232)	5.59	0.845* (0.192)	4.40	0.98* (0.31)	3.21
Kenya	-0.101 (0.122)	-0.83	0.247 (0.218)	1.13	-0.001 (0.15)	-0.01
Nigeria	-0.307* (0.099)	-3.09	1.090* (0.185)	5.90	-0.38* (0.13)	-3.00

* Significant at 1 percent level. # Significant at 5 percent level. ** Coefficients taken from equation no. (5). Standard errors are given in parentheses.

Table no. 9 shows that EXP is significant in two cases out of five. The error correction term λ is significant in four cases out of five (except Kenya) and its coefficient estimate has a positive sign which implies that the difference of the two series EXP and GDP scaled by the parameter b reaches stationarity. This process confirms that an equilibrium relationship between the two series will be attained in the long run.

To find out the existence of Keynesian hypothesis, table no 9 (sixth column) shows us that in Turkey as well as in Nigeria, in both cases, government expenditure is statistically significant. However the coefficient estimate for Turkey has a positive sign whereas the coefficient of Nigeria has a negative sign. That means Turkey data is supportive of the Keynesian hypothesis according to the ECM test.

4.3 Empirical Results for Granger Causality

The Granger causality test results are given in table 10. The test results are carried out using stationary data. Four lag lengths are chosen to estimate the effect. The null hypothesis of noncausality is tested using F-statistics. The results of F-statistics are given in table 10.

Table no. 10, Granger causality test

Country	Direction of causality	F – Value				Null Hypothesis of No Granger Causality Decision
		Lag 1	Lag 2	Lag 3	Lag 4	
Indonesia	GDP → EXP	4.72	2.76	2.04	1.60	**Reject at lag 1**
	EXP → GDP	2.16	0.99	1.12	0.82	**Do not reject**
Myanmar	GDP → EXP	1.39	2.10	1.68	1.29	**Do not reject**
	EXP → GDP	4.00	2.05	1.44	1.21	**Reject at lag 1**
Turkey	GDP → EXP	1.43	0.80	0.66	0.57	**Do not reject**
	EXP → GDP	0.89	0.66	0.51	1.06	**Do not reject**
Kenya	GDP → EXP	5.01	4.80	3.59	3.25	**Reject at all lags**
	EXP → GDP	9.02	7.41	4.72	3.31	**Reject at all lags**
Nigeria	GDP → EXP	0.58	1.10	0.70	0.77	**Do not reject**
	EXP → GDP	0.13	0.07	1.37	2.24	**Do not reject**

Note: For the lag 1, F Distribution at 5% (2, 28) is 3.35
For the lag 2, F Distribution at 5% (4, 25) is 2.76
For the lag 3, F Distribution at 5% (6, 22) is 2.55
For the lag 4, F Distribution at 5% (8, 19) is 2.48

According to above table, the following results have emerged. There is no causality from both the directions for Turkey as well as for Nigeria. Because calculated F-statistics are less than 5% F-statistics value at all lags, which did not

help to reject the null of no Granger cause. Unidirectional causality from GDP to government expenditure is found in Indonesia, supporting Wagner's law. The null hypothesis of no Granger causality is rejected only at first lag in Indonesia.

Similarly, unidirectional causality from government expenditure to GDP growth in the case of Myanmar is found where the null hypothesis is rejected at first lag, which shows the data are consistent with the Keynesian hypothesis.

In the case of Kenya, bidirectional causality is found, that is, causality from both ways supporting Wagner's law as well as Keynesian hypothesis. The null of no Granger causality is rejected at all the four lags for both series. In other words calculated F-statistic values are higher than the given 5% critical F- values in all cases for Kenya.

Chapter – 5

5.1 Conclusion and Suggestions for Future Research

In this chapter conclusion of the thesis and suggestions for the future research are presented.

5.2 Conclusion

In order to find out the causality between government expenditure and GDP growth the standard Granger causality test is done using time series data of 8 developing countries for the period 1972 – 2003. First of all ADF test for unit root is done to find out the order of integration. I found both the series are integrated of order 1 for four countries namely Indonesia, Turkey, Kenya and Nigeria. I also found that GDP and EXP are integrated of order 2 for Myanmar. However, the test result showed that the both the series are not integrated of same order for three countries namely Burkina Faso, Senegal and Swaziland.

To establish a long-run relationship between the two variables a co-integration test is applied (Engle and Granger's two stage residual based approach) to all five countries. According to DF test there is a co-integration in series for Myanmar. Similarly, ADF test for residual established a co-integration between the two series for Indonesia, Turkey, Kenya and Nigeria.

After a long-term relationship is established between the two series, an Error Correction Mechanism (ECM) is estimated. While testing the existence of the Wagner's law, the error correction term, λ, in table (5) confirms that the equilibrium

relation between the two series will be attained in the long run in all the five countries.

Similarly, the existence of Keynesian hypothesis is described after doing ECM in table 9. In this table, the error correction term, λ, confirms that the equilibrium relation between the two series will be attained in the long run for four countries (except Kenya). Moreover, this table suggested the existence of Keynesian hypothesis holds only in Turkey.

At the final stage of the thesis, I carried out standard Granger causality test in order to find out the causal relationship between the two series. On the basis of empirical results, the following broad conclusion is emerged. First, in two countries namely Turkey and Nigeria no causality is found from the both ways. Second, in Indonesia a unidirectional causality from GDP to EXP is found at first lag supporting Wagner's law. Third, conversely a unidirectional causality from EXP to GDP is found at its first lag in the case of Myanmar supporting Keynesian hypothesis. Fourth, bidirectional causality, meaning that EXP causes GDP growth and GDP growth causes EXP, is confirmed at all four lags for Kenya.

The overall hypothesis of this thesis was to find the Keynesian hypothesis in all the selected countries. Out of eight countries, five were qualified to go for cointegration test and out of these five countries only two, Myanmar and Kenya are supportive of the hypothesis. While collecting the government expenditure data, I collected total government expenditure. The collected total expenditure data included military expenditure as well as regular expenditure. We can't expect that such

expenditures help GDP to increase. Therefore if such expenditures were excluded form the model, I could have got the existence of Keynesian hypothesis for all the countries in the result.

Similarly, causality can also be affected by some other control variables, like investment, interest rate, inflation etc. These variables are intimately connected with EXP and GDP. If I had carried out a trivariate model instead of bivariate, I could have obtained different results.

5.3 Suggestions for Future Research

Following are suggestions for further research.

1. While collecting the expenditure data, it is worth while to exclude military expenditure as well as other regular expenditures. Because these kind of expenditures will not help the country to achieve a higher rate of GDP.
2. While doing Granger causality test generally the bivariate test is performed. If a third variable can be included making the model trivariate, it can help to get the different result than we generally get from bivariate model.
3. While doing Granger causality test we need to fix the lag orders. As more lag lengths are used, we could have more effective results. If the sample size is small then we can't expect to use a long lag length. In order to get a good result from the model we have to have at least 40

observations. Therefore, while collecting the data, I would like to suggest students and future researchers to collect as more observations as possible.

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Web site: www.eiu.deu (jstor) and www.google.com

World Development Indicator (WDI), CD-ROM, 2005.

Appendix – A

Year	Indonesia		Myanmar		Turkey		Burkina Faso	
	GDP	EXP	GDP	EXP	GDP	EXP	GDP	EXP
1972	7.8827	98.6192	2.4358	102.3858	7.4259	102.3965	2.3115	114.8893
1973	9.7762	97.5909	-0.9681	100.2045	3.2622	101.9540	0.4493	116.6077
1974	8.2569	90.6662	5.3424	101.9898	5.5945	105.2857	8.2864	116.1522
1975	6.1834	97.0146	4.1527	101.1756	7.1741	106.5020	2.9984	122.8029
1976	5.9882	96.9941	6.0804	101.2615	10.4613	105.5763	8.5349	118.8030
1977	8.6365	94.3502	5.9523	104.2778	3.4066	106.6364	0.3703	122.4830
1978	9.2056	96.7933	6.5178	107.2170	1.5030	103.0444	4.6078	120.2824
1979	7.0926	91.9913	5.2013	104.8340	-0.6241	102.5951	3.6646	121.0363
1980	8.7250	86.0314	7.9385	103.8437	-2.4473	106.7648	0.7969	122.3120
1981	8.1482	94.9825	6.3558	106.2873	4.8566	104.6674	4.2553	122.1587
1982	1.1041	98.7546	5.6039	108.7244	3.5634	103.1525	9.5622	123.4283
1983	8.4499	101.5179	4.3911	103.6610	4.9710	104.0849	0.3460	121.6900
1984	7.1721	96.4907	4.9327	103.5599	6.7120	104.0667	-1.7787	117.7969
1985	3.4775	98.2486	2.8510	103.9936	4.2415	103.1055	8.5174	122.4143
1986	5.9645	100.9994	-1.0573	102.5700	7.0120	102.7895	8.4953	122.3952
1987	5.3000	98.4632	-4.0056	103.5096	9.4852	102.1766	-1.3530	119.9259
1988	6.3557	97.3142	-11.3524	101.7247	2.1206	98.8988	6.6295	115.3616
1989	9.0847	97.1203	3.6953	100.2254	0.2518	101.5779	0.9289	114.3943
1990	9.0016	98.4049	2.8169	102.2140	9.2552	104.2816	-1.5180	113.0092
1991	8.9278	98.3049	-0.6506	101.2907	0.9266	102.7938	8.7000	112.8598
1992	7.2205	97.0669	9.6609	100.7117	5.9842	102.9529	0.3000	112.4935
1993	7.2541	97.0138	6.0394	100.8270	8.0423	105.6695	4.6000	112.9065
1994	7.5401	98.8542	7.4780	100.4249	-5.4554	99.0216	1.0000	112.3412
1995	8.3964	101.3343	6.9481	100.7727	7.1899	104.4594	4.6000	114.6451
1996	7.6428	100.6156	6.4427	100.6272	7.0060	105.9469	7.1000	116.1892
1997	4.6999	100.2754	5.6516	100.5456	7.5292	105.8048	5.2000	115.0874
1998	-13.1267	90.2499	5.8662	100.5740	3.0919	103.5614	1.0000	115.5964
1999	0.7911	91.9157	10.9451	100.3369	-4.7089	103.6544	6.7000	115.7133
2000	4.9201	90.5390	13.7459	100.0953	7.3591	107.4854	1.6000	116.1723
2001	3.4500	91.7700	9.7000	100.2500	-7.4943	97.5959	5.9000	113.8800
2002	3.6900	93.4300	8.5000	100.3500	7.9400	101.4800	4.4000	113.1400
2003	4.1000	94.4600	7.4700	100.3900	5.7900	103.2900	6.5000	114.8200

Appendix – A (continued)

Year	Kenya		Nigeria		Senegal		Swaziland	
	GDP	EXP	GDP	EXP	GDP	EXP	GDP	EXP
1972	17.0824	102.1393	3.3643	100.8274	6.3832	103.4533	5.4243	91.2442
1973	5.8966	101.2752	5.3928	99.4319	-5.5832	109.0454	9.0187	83.6323
1974	4.0656	107.2216	11.1607	89.3899	4.2008	105.0837	5.7435	74.9687
1975	0.8822	104.6879	-5.2277	104.4928	7.5357	104.4308	13.9084	83.9738
1976	2.1540	99.3052	9.0424	105.7065	8.9205	106.8861	-2.1194	91.8402
1977	9.4538	96.6342	6.0241	97.6504	-2.6829	107.4470	1.0096	103.2625
1978	6.9125	109.7525	-5.7642	104.2096	-3.9539	112.3571	1.3271	123.8224
1979	7.6152	106.0040	6.7594	94.2461	7.0017	109.0400	3.1069	136.3951
1980	5.5920	111.1074	4.2048	89.8210	-3.3106	116.6841	12.4491	127.6416
1981	3.7735	108.1205	-13.1279	104.0508	-1.1783	121.8714	0.4790	127.6416
1982	1.5065	103.7492	-0.2347	105.9671	15.3328	114.7474	0.4790	125.5268
1983	1.3091	100.4479	-5.2945	103.9159	2.1754	114.6549	2.0752	128.8023
1984	1.7552	101.3770	-4.8183	98.1021	-4.0021	112.1021	6.2363	128.0192
1985	4.3006	101.0633	9.7048	96.3411	3.7972	113.4129	3.7626	128.2118
1986	7.1776	99.8255	2.5136	103.4026	4.5326	107.2311	12.2700	107.5417
1987	5.9371	105.1007	-0.7004	96.0610	4.0056	107.3354	14.6500	93.2397
1988	6.2032	105.2925	9.8995	98.9046	5.0690	106.3644	6.6800	101.0678
1989	4.6903	106.1368	7.2003	92.4616	-1.4055	105.4409	9.1200	100.6802
1990	4.1921	105.3321	8.1960	85.3786	3.8914	104.8854	8.5600	99.1937
1991	1.4383	101.0038	4.7556	94.1190	-0.4002	103.3644	2.6100	114.4770
1992	-0.7995	100.0384	2.9182	98.2622	2.2189	105.9357	1.1900	125.0718
1993	0.3532	93.9557	2.1995	103.0787	-2.2211	105.9631	3.5100	125.2004
1994	2.6328	96.8205	0.1000	99.0061	2.8666	106.6587	3.3500	118.0071
1995	4.4062	106.2266	2.5000	97.8967	5.1663	105.6410	3.7600	118.6324
1996	4.1468	103.5755	4.3000	79.2998	5.1415	106.3198	3.9300	126.0030
1997	2.0764	107.4821	2.7000	92.7992	5.0420	106.6604	3.8300	117.2598
1998	1.6214	107.9648	1.8794	104.5420	5.7413	106.6636	3.2400	119.0898
1999	1.2916	105.9241	1.1004	104.0337	5.0031	107.1567	3.5300	118.4463
2000	-0.1645	109.7000	4.2002	84.2642	5.5848	109.9419	2.0300	115.3500
2001	1.1320	109.2800	3.1000	91.1200	5.5684	109.5627	1.8000	111.2000
2002	1.0700	101.2200	1.5500	100.2300	1.1400	109.6500	3.4200	108.8900
2003	1.8000	104.6700	10.6900	90.9300	6.4500	112.0100	2.2000	110.1600